

SPECIFICATION AMENDMENTS

Please replace the paragraph that begins on page 1, line 10 with the following:

A1
Magnetic recording is a ~~predominate~~ predominant method for mass data storage, and is expected to remain a predominant method for the foreseeable future. Demand for hard disk drive capacity, for example, is doubling every year. There is continuous pressure to decrease the cost per byte of mass storage devices. As a result, magnetic storage device manufacturers strive to provide higher capacity and faster performance from hard disk drives.

Please replace the paragraph that begins on page 1, line 18 with the following:

A2
At one time, capacity could be increased simply by providing more disks and more read/write heads in a single enclosure. However, space and power requirements make the prior practice of simply adding more disks and heads to a hard drive ~~is~~ less and less effective. Hence, disk drive suppliers continue to increase areal densities, or the number of data bits per square inch of recording media, to meet the increasing demand for storage at competitive pricing. Read and write head design are key technologies needed to achieve these capacity increases.

Please replace the paragraph that begins on page 3, line 10 with the following:

A3
However, perpendicular recording systems use a magnetically soft underlayer that ~~require~~ requires relatively low fields to become magnetized. As a result, perpendicular recording systems have been more sensitive to stray fields by a factor of 3 to 10 as compared with longitudinal recording. Perpendicular error rates are strongly affected for applied fields of about 10-15 Oersteds (Oe), as compared with 30-50 Oe for longitudinal recording.

Please replace the paragraph that begins on page 3, line 31 with the following:

A4
It has been noted by the inventors of the present invention that the structures used in conventional read/write head devices, particularly in read/write devices for perpendicular recording, capture the stray magnetic fields and ~~coupled~~ couple the stray magnetic fields to the recording media in an undesirable fashion. These structures include shields around the read head that are intended to block fields produced by neighboring portions of the recording media so that the read head reacts only to magnetic fields produced in an area directly under the read device. Similarly, the pole or poles in the write head are engineered to promote perpendicular fields, and consequently are sensitive to capturing stray perpendicular fields. Accordingly, a need exists for a recording system and a method for operating a recording system that reduce sensitivity to stray fields, especially in perpendicular recording systems.

Please replace the paragraph that begins on page 4, line 15 with the following:

A5
Briefly stated, the present invention involves ~~A method~~ a method for reducing flux concentrating capacity of a shield in a magnetic read/write head positioned to read perpendicular residual magnetic fields on a magnetic media. Permeability of the shield is reduced in a direction oriented perpendicular to the magnetic media by inducing a transverse magnetic bias field within the shield.

Please replace the paragraph that begins on page 7, line 5 with the following:

A6
Platters 201 are coupled together via a spindle to a spindle motor 204. Spindle motor 204 operates under control of control electronics (not shown) to maintain the spin speed of platters 201 in a carefully defined range. Spindle motor 204 is a contributing factor to stray magnetic fields produced by the drive, however. While

AS

manufactures can take steps to shield platters 201 with the single enclosure ~~form~~ from the fields produced by motor 204, these field still do affect neighboring devices 102.

Please replace the paragraph that begins on page 7, line 14 with the following:

AS

Read/write heads 203 are mounted ~~on~~ via arm 202 to a servo position mechanism formed by spindle 206 and servo motor 205. These mechanisms cooperate to move the read/write heads from the inner to outer portions of each platter 201. Servo motor 205 must move very fast to provide low seek times (i.e. the time required to position the read/write head over a particular portion of platter 201. Because of this, servo motor 205 is typically implemented with a relatively powerful motor that produces a significant magnetic field. This magnetic field contributes to the stray magnetic fields affecting neighboring drives 102.

Please replace the paragraph that begins on page 9, line 15 with the following:

AS

It is desirable to decrease the flux gathering capacity of the shields, to reduce the stray field sensitivity to a level similar to longitudinal recording. One way to do this is to reduce the shield height to make the shape demagnetization factors similar to the case without the underlayer (i.e., reduce the shield height by 2X). Alternatively, the magnetic properties of the materials chosen to manufacture shields 301 may be engineered to tailor the flux gathering properties. These may be satisfactory approaches if other elements of the head design will permit such a change. In the case of the write element (not shown), such a change in geometry may be unrealizable because of the need for forming the coils, yoke, and other structures constrains the ability to make changes to the physical size of components. Moreover, material

AS

changes tend to be difficult to incorporate in integrated structures and increase the expense of manufacturing.

Please replace the paragraph that begins on page 14, line 3 with the following:

AG

Figure 8 shows the error rate versus perpendicular applied field for a sample head. It should be noted that, the error rate is improved in Fig. 8 by about one order of magnitude by the transverse field in this case, which is due to an improvement of signal-to-noise ratio, rather than ~~reduce~~ reduced bit shift. A fit of the error rate to an inverse Gaussian indicates reduction in transition shift appears to be reflected in improved stray field sensitivity, aside from the improvement in signal to noise ratio. Interestingly, the error rate performance and the symmetry of positive and negative going pulses is usually best for some value of perpendicular applied field, which is head dependent.

Please replace the paragraph that begins on page 15, line 24 with the following:

A10

It is contemplated that the present invention might be useful for longitudinal recording as well. For longitudinal recording, the error rate is far more sensitive to the application of a perpendicular field ~~that~~ than to the application of a radial field. Thus, reduction of the permeability of the shields in the vertical direction is also expected to reduce the flux-gathering properties of the head. For low density head-media designs, the margin for error rate was large, typically three orders of magnitude or so. Thus, conventional drives could withstand substantial error rate loss before they no longer were able to recover user data. For drives in the future, it is expected that the error rate margin of the drive will fall significantly. Thus, the level of robustness of the head to stray fields provided by current designs may be insufficient

in the future, and the present invention may be employed to improve the robustness to stray fields.

A10